Sudden infant death syndrome, maternal smoking during pregnancy, and the cost-effectiveness of smoking cessation intervention

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The use of a smoking cessation programme was examined. The details of the intervention were not provided.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised infants who died because of SIDS, or who survived after one year of life. Multiple births were not considered.

Setting
The setting was not explicitly stated. The economic study was conducted in the USA.

Dates to which data relate

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was not conducted on the sample of patients as that used in the effectiveness study.

Study sample
Power calculations to determine the sample size were not performed. The sample of SIDS infants comprised 3,064 cases. Maternal smoking data were available for 2,516 infants, but not for the remaining 548 cases. The sample of infant survivors comprised 3,779,607 cases. Smoking data were available for 2,962,512 cases, but not for the remaining 817,095 cases. Each case in the SIDS group was matched to at least one case in the surviving group with identical state of birth, gender, maternal race/ethnicity, maternal age, marital status at birth, and maternal years of education.

Study design
This was a historical cross-sectional study that evaluated data for children born in 1995. The data were derived from the Perinatal Mortality Files database. The author described the procedure used to gather the data from the database and avoid double-counting. The database referred to the US 1995 birth cohort. Information on maternal smoking habits was reported. The data were self-reported and there was no follow-up due to the study design.

Analysis of effectiveness
A multiple regression analysis was conducted to describe socio-economic correlates of SIDS risk. Smoking habits were classified as light (1 to 10 cigarettes/day), moderate (11 to 20 cigarettes/day) or heavy (more than 20 cigarettes/day). A conditional logistic regression based on a case-control framework was also implemented, as an alternative analysis, to take several potential confounding factors into consideration.

Effectiveness results
The multiple regression analysis showed that the adjusted odds ratio (OR) in the full sample was 2.466 (95% confidence interval, CI: 2.30 - 2.726) for light smokers, 3.018 (95% CI: 2.649 - 3.438) for moderate smokers and 3.221 (95% CI: 2.418 - 4.289) for heavy smokers. This means that prenatal maternal smoking more than doubled the estimated risk of SIDS.

Among the other correlates, the most important results suggested that race/ethnicity was strongly correlated with SIDS risk. Infants born to black people had a higher risk of SIDS, while those born to Hispanics or Latinos experienced a significantly lower risk than those born to non-Hispanic whites.

The conditional logistic regression confirmed the previous findings. The adjusted OR was 2.511 (95% CI: 2.26 - 2.789) for light smokers, 3.249 (95% CI: 2.835 - 3.723) for moderate smokers and 3.847 (95% CI: 2.866 - 5.162) for heavy smokers.

Clinical conclusions
The effectiveness analysis showed that maternal smoking had a significant and strong effect on the risk of SIDS.

Measure of benefits used in the economic analysis
The summary benefit measure used in the economic analysis was the number of SIDS deaths averted if pregnant smokers enrolled in a typical smoking cessation programme, compared with no intervention. This was based on the adjusted ORs calculated in the effectiveness study, assuming that a typical smoking cessation intervention would result in a quit rate of about 15% among pregnant smokers (see Other Publications of Related Interest).

Direct costs
The cost of the smoking cessation programme was derived from a published study (see Other Publications of Related Interest). Details of the study were not reported. The cost categories included in the analysis and the cost/resource boundary adopted were also not stated. The costs were estimated in 1986 values and then inflated to 1998 values. The cost of the comparator (no smoking cessation intervention) was likely to have been 0.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not included in the economic analysis.

Currency
Sensitivity analysis
Sensitivity analyses were not conducted.

Estimated benefits used in the economic analysis
Compared with no intervention, the number of SIDS deaths averted if pregnant smokers enrolled in a typical smoking cessation programme was 108 (95% CI: 102 - 114) for all pregnant smokers, 63 (95% CI: 58 - 68) for those smoking 1 to 10 cigarettes/day, 39 (95% CI: 36 - 41) for those smoking 11 to 20 cigarettes/day, and 6.9 (95% CI: 5.9 - 7.6) for those smoking more than 20 cigarettes/day.

If all pregnant smokers were to cease smoking (regardless of the smoking cessation programme), the corresponding figures would be 722 (95% CI: 677 - 763) for all smokers, 422 (95% CI: 388 - 453) for light smokers, 258 (95% CI: 239 - 274) for moderate smokers, and 46 (95% CI: 40 - 50) for heavy smokers.

Cost results
The study that provided the cost data estimated that a smoking cessation programme cost $45 per participant at 1998 values. The total costs were not reported.

Synthesis of costs and benefits
An incremental cost-effectiveness ratio was calculated to combine the costs and benefits of the study intervention.

Relative to no intervention, the estimated cost per averted SIDS death for the smoking cessation programme was $210,500 (95% CI: 119,200 - 224,400) for all pregnant smokers, $235,400 (95% CI: 219,300 - 256,400) for those smoking 1 to 10 cigarettes/day, $177,300 (95% CI: 166,800 - 191,100) for those smoking 11 to 20 cigarettes/day, and $151,000 (95% CI: 137,200 - 174,500) for those smoking more than 20 cigarettes/day.

Authors’ conclusions
The smoking cessation programme cost $210,500 per sudden infant death syndrome (SIDS) death averted, although it had a modest impact on the population incidence of SIDS. Assuming a 75.4-year estimated life expectancy for infants who survived to 1 year of age, and a conventional 5% annual discount rate, then the prenatal smoking cessation programme cost less than $11,000 per life-year. This represents a reasonable figure for a programme that improves public health.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparator was clear. No intervention was selected as the basic comparator because it represented the standard approach. Also, the aim of the study was to estimate the additional costs of the smoking cessation programme. You should decide whether no programme is a valid comparator in your own setting.

Validity of estimate of measure of effectiveness
The analysis of effectiveness used a historical cross-sectional study, which was useful as it offered the picture of the incidence of disease in a specific birth cohort in the USA. However, exposure and disease were evaluated at the same time and no explicit comparator was considered. Indeed, the effectiveness study aimed to estimate the relationship between a specific factor (prenatal maternal smoking) and the incidence of disease, although the author stated that "the precise etiology of this relationship is unknown". A further limitation of the analysis was the use of self-reported data, which, as the author acknowledged, cast some doubts on the observed results of the analysis. Data on postnatal smoking and other household tobacco exposures were unavailable. The value of reduced smoking among women who relapsed was not considered. The author also stressed that sub-group analyses should have focused on specific ethnic groups,
such as Asian/Pacific Islanders and Native Americans. These issues tend to limit the internal validity of the analysis.

**Validity of estimate of measure of benefit**
The benefit measure was derived from the effectiveness study and using the quit rate reported in a published study. Since it represented a disease-specific measure, comparisons with the benefits of other health programmes appear to have been difficult.

**Validity of estimate of costs**
The economic analysis focused on the cost of the smoking cessation programme, which was estimated from a published study, the details of which were not provided. It was stated only that 1998 values were used to report the costs.

**Other issues**
The authors made some comparisons of their findings with those from other studies. However, they did not address the issue of the generalisability of the study results to other settings. Sensitivity analyses were not conducted and the overall external validity of the analysis was low. The author noted some limitations of the analysis and stressed that the impact of the intervention on multiple births was not estimated, although it would have been interesting. It was also highlighted that the analysis focused only on SIDS prevention and that other benefits of smoking cessation were not considered.

**Implications of the study**
The author suggested that a smoking cessation programme for pregnant women should remain an important policy goal due to its wide range of benefits. However, caution is required when interpreting the results of the study due to the limitations of the analysis.

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**Other publications of related interest**

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